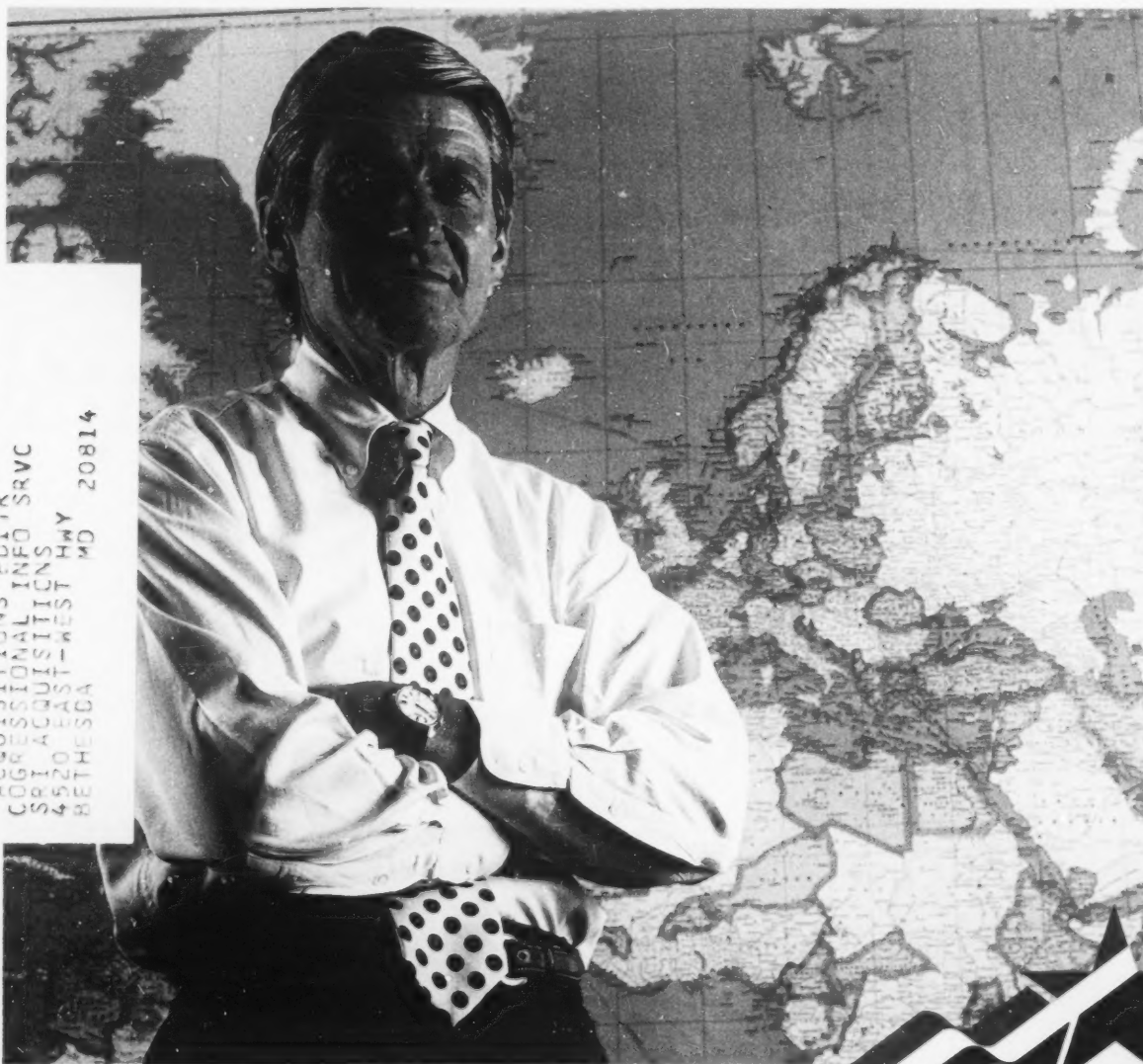


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Electronic Business®

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Computer Business: IBM takes on DEC with the 9370 PAGE 82



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KEEPING AMERICA
COMPETITIVE

Electronic Business

VOL. 13, NO. 19

OCTOBER 1, 1987

FOR THE MANAGEMENT TEAM IN ELECTRONICS, COMPUTER AND SYSTEMS COMPANIES



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V BPA ABP

Components and distribution still lead the recovery

There's still plenty of growth ahead, as equipment sales recover. A bonus for N.V. Philips?

The Dutch electronics giant, N.V. Philips' Gloeilampenfabrieken, is currently tendering to increase its ownership of United States-based North American Philips Corp. from 58% to 100%. Although its interest in total ownership may respond to a long-term plan, it has a clear short-term benefit because North American Philips is the largest supplier of nonsemiconductor components in the United States. Thus, N.V. Philips will be able to reap fully the benefits of the current recovery in the market for passive and electromechanical components, as it does currently in the IC market recovery through its 100% ownership of Signetics Corp.

It is clear that chips and other components, as well as the distribution of these components, are leading the recovery. Moreover, the fact that components manufacturers continue to lead the recovery ahead of the business of their major customers — the manufacturers of computers, communications, and other electronic equipment — suggests that there is still plenty of growth ahead. For example, the ELECTRONIC BUSINESS index for revenue, a composite of company revenue from all segments of the electronics industry, grew by only 8% in the second quarter with respect to the same quarter a year earlier. The index's performance was dragged down by IBM, because Big Blue's revenue in that quarter was up a slim 4%.

By contrast, AMP Inc., the largest manufacturer of connectors and interconnection components, saw its sales increase by 19% in the second quarter. Molex Inc., five times smaller than AMP, registered 18% growth. Augat Inc., whose revenue is one-seventh as large as AMP's, went up by 20%. Growth was 21% for capacitor manufacturer AVX Corp., which is a little smaller than Augat.

Chip makers also have seen revenue increase substantially in the second quarter. Intel Corp. racked up a 44% increase, AMD, 25%. Distribu-

tors have also participated in the recovery because most of their sales consist of semiconductors and other components. Revenue by the No. 1 industrial distributor, Avnet Inc., advanced 12% in that quarter.

If, as expected, the components manufacturers lead the recovery, they will see more business coming their way as the equipment manufacturers' business starts to recover. Third quarter results have not been released yet,

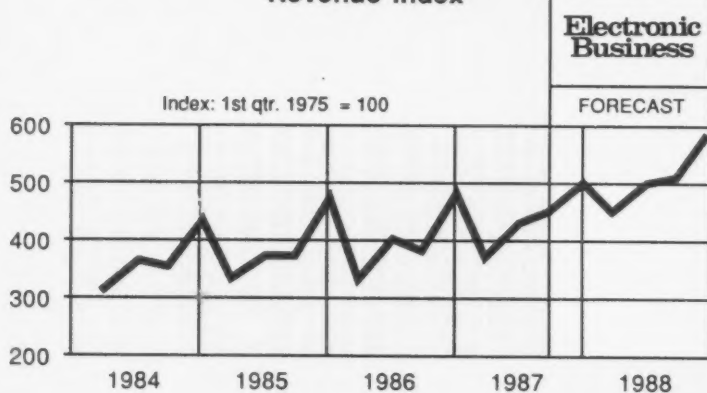
but Cahners Economics forecasts that the revenue index growth will have speeded up to 15% in the third quarter, and that it will end the year with a bang, pushing 1987 revenue 10% higher than 1986's. More significantly, Cahners forecasts that profits will break a two-year decline and be up 26% in 1987.

North American Philips' sales of components, almost all in the United States, may be close to \$500 million. At that range, its sales can grow by 20% in the next 12 months. No wonder its Dutch parent wants all of it.

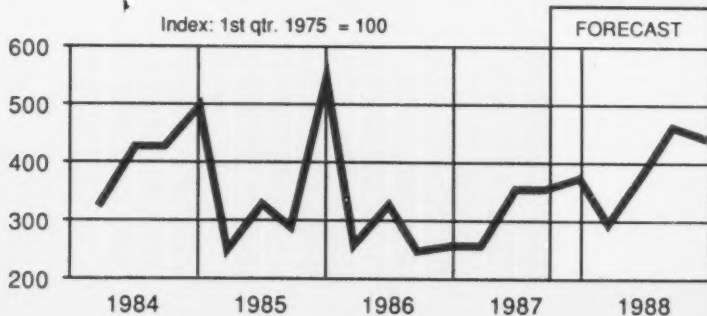
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Electronic Business indexes

Revenue index

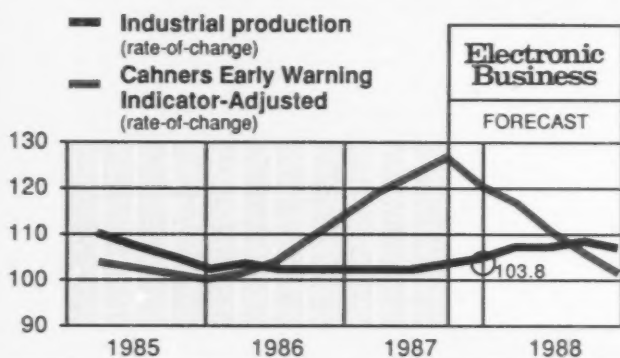


Profit index



Historical data: Dow Jones News/Retrieval; Forecast: Cahners Economics

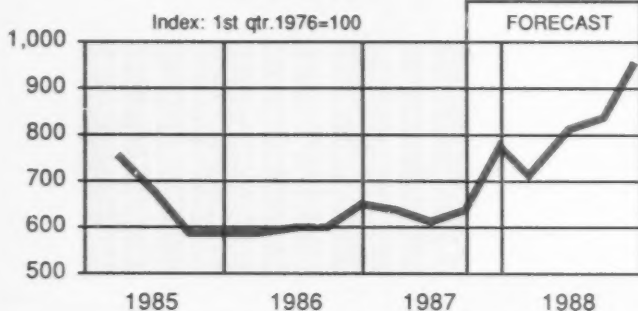
Economic indicators



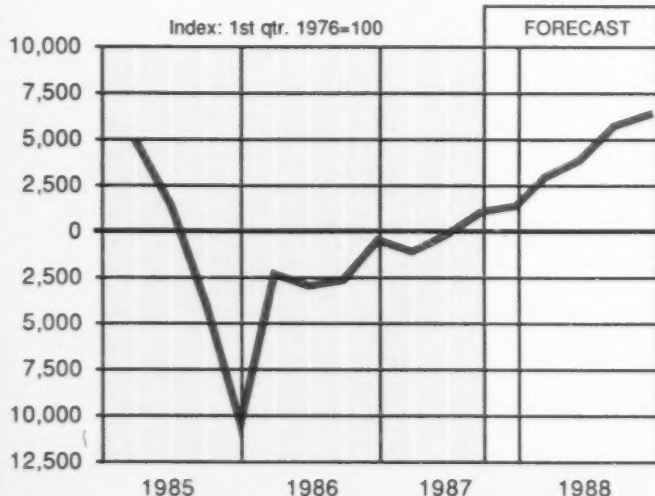
Historical data: Federal Reserve Board; Forecast: Cahners Economics

ATE indexes

Revenue



Profits



Historical data: Dow Jones News/Retrieval; Forecast: Cahners Economics

Steady growth expected

The United States Index of Industrial Production, a coincident indicator of the U.S. economy, has been climbing steadily since the summer of 1986. This spring, output rose 0.7%, according to estimates from the Federal Reserve Board. This slow and steady growth is expected to continue until next summer. Production is expected to rebound after a year and a half of sluggish growth, pushing production up 6.8% in 1988. The impetus for this upturn will be increasing U.S. exports, due to the decline in the value of the dollar; inventory replenishment; and growth in business equipment investment.

A leading indicator, the Cahners Early Warning Indicator (CEWI), is a weighted average of housing starts, the Dow Jones Industrial Stock Index and the money supply (M2) — deflated by the Consumer Price Index. The CEWI has proven to be an excellent forecasting tool. It forecasts the turning points in the economic business cycles about 12 months in advance. Presently, it points to an upturn in the economic business cycle with the next business peak in August of 1988. The black curve is a plot of the 12-month rate-of-change Index of Industrial Production. That is, its change over a 12-month period can be determined by comparison with the line at 100. For example, the 103.8 level forecasts using the CEWI for the end of this year indicates that the average for all of 1987 should be 3.8% above 1986.

The CEWI has been adjusted to compensate for the recent rapid changes in the financial indicators. More information can be obtained from Elizabeth Baatz, economist, Cahners Economics Department, 275 Washington St., Newton, Mass. 02158.

ATE revenue and profit

Although automatic test equipment manufacturers' second quarter revenue fell 4.0% from the prior quarter, it was up 4.2% from the year-ago quarter and increased by 6.2% in the first half of the year from the same period a year ago. Although second quarter revenue was down, demand from computer and semiconductor manufacturers for automatic test equipment shows further signs of strengthening. This year a 10.0% increase is forecast, followed by a sharp 25.8% rise in 1988. ATE manufacturers continued to rack up losses into the first half of 1987. A return to profitability is expected during the second half of the year.

CAE

One niche where Daisy and Valid outpace Mentor

The application-specific hardware market is tiny, but future growth could sizzle. Mentor may miss the boat

Although Mentor Graphics Corp. dominates the overall electronics CAE industry, the company's performance in one important niche has been less than stellar. The market for so-called "application-specific hardware" is controlled by Mentor rivals Daisy Systems Corp. and Valid Logic Systems Inc.

According to Prime Data Inc. of San Jose, Daisy and Valid together controlled about three-quarters of the 1985 and 1986 shipments of hardware built to perform a specific CAE function. This category includes simulation accelerators (hardware engines that speed up the software simulation function) and physical modelers (hardware that enables physical chips to be simulated in conjunction with software).

It is a small but significant victory for Daisy and Valid. The market for application-specific hardware (ASHW) will surge from \$80 million this year to \$415 million by 1990,

according to The Technology Research Group Inc. (TRG), a Boston-based research firm. Even though ASHW will account for just 8% of the total computer-aided engineering market this year, TRG claims that it will account for 16% of CAE in 1990.

"Accelerators will definitely grow faster than the overall market," agrees Robert Moore, vice president for product and industry marketing at Daisy, based in Mountain View, Calif. Adds Larry Potter, a general manager for Hewlett-Packard Co.'s CAE business, "There's a huge market potential for these types of products."

But the trick is figuring out how to tap that potential. So far, the ASHW market has not grown as fast as previously predicted.

High price tags have been the culprit, says David Niehaus, CAE product marketing manager for Cadnetix Corp. of Boulder, Colo. Previously, says Niehaus, "vendors charged as much as the customer could stand."

Indeed, the cheapest hardware accelerator cost more than \$300,000 several years ago. "These things have to be \$20,000 to \$30,000," contends Niehaus. Not coincidentally, Cadnetix introduced last June an accelerator with a base price of \$31,000.

Another reason for the market's sluggishness has been that customers have had difficulty integrating ASHW with other CAE products. "We need to do a better job of integrating things or the market potential will remain just that, a potential," admits HP's Potter. "The wrong products have been sold," asserts William Loesch, president of start-up Ikos Systems Inc. of Sunnyvale, Calif. Users have had to spend too much time and money integrating these products, says Loesch. "We must provide customers with a solution, not another problem."

One of the reasons Daisy has been so successful in this niche, says TRG president Andrew S. Rappaport, is because the company has been able to integrate its ASHW better. "On a technical level," says Rappaport, "Daisy's MegaLogician is probably among the worst hardware accelerators ever introduced into the marketplace. However, it didn't make a bit of difference because it was the first working accelerator to be integrated with a popular software simulator." Adds Daisy's Moore: "By only looking at the spec sheets, sure, our accelerator is not as advanced as Zycad's... But the real issue is: What does the user get out of it?" Clearly, Daisy's customers get the benefit of seamless integration.

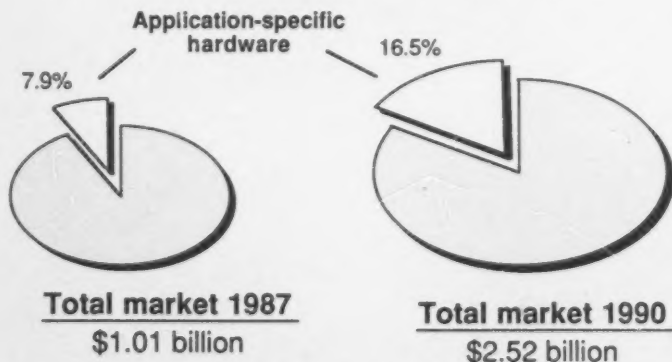
Mentor's customers, on the other hand, reportedly have struggled. Unlike Daisy, which sells a homemade simulation accelerator, Mentor relies on one from Zycad Corp. of St. Paul, Minn. Using the Zycad accelerator with Mentor's products, asserts Rappaport, "has been a real problem."

Mentor, headquartered in Beaverton, Ore., does not seem too intent on addressing the problem. According to president Gerard H. Langelier, the company has stopped its R&D work in accelerator technology. This happened after Compute Engine, Mentor's homemade accelerator, all but flopped in the marketplace, according to some outside observers. Langelier says that his company will now depend on outside help for its future accelerators.

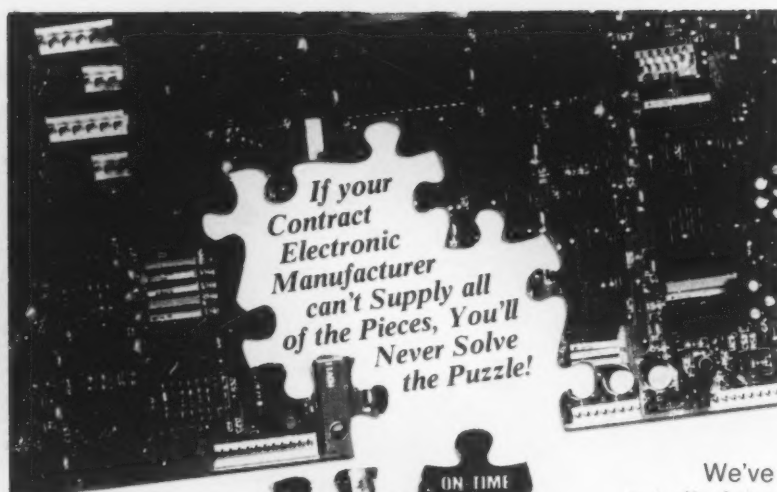
Some experts believe that Lange-

The market for application-specific hardware will surge

Total worldwide CAE market (including hardware and software)



Source: The Technology Research Group



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ler's strategy is not wise. "Mentor's reluctance to invest in accelerator technology is opening up an enormous opportunity for a company to go in and beat them at the analysis [the raison d'être of CAE] game. Unless Mentor makes a more solid commitment to hardware assistance, you're going to see companies beating them there," asserts the TRG's Rapaport.

Mentor, however, will continue investing R&D resources in physical modeling technology, says Langelier. But Valid, headquartered in San Jose, is striving to derail Mentor's strategy. Last June, Valid initiated a patent violation lawsuit regarding the physical modeling technology. In addition to Mentor, Cadnetix, Daisy, GenRad Inc., HHB Systems and Teradyne Inc. were also named in the suit. Teradyne has since settled out of court. "We think we have a real strong case," asserts W. Douglas Hajjar, Valid president. Not surprisingly, Daisy's Moore disagrees: "We feel that the suit has no merit." Valid aggressively is seeking triple damages in addition to license and royalty fees, according to Hajjar.

Lawsuit notwithstanding, Valid is busy working on a next-generation product. The company recently spun off its physical modeling efforts into a separate company — Logic Modeling Systems Inc. The new venture is privately financed with Valid holding an equity position. Hajjar says that Valid spun off LMSI so that it would not become a resource drain.

Apparently, Valid's efforts in accelerators had become something of a drain. Joseph A. Prang, Valid vice president for product marketing, says that his company, like Mentor, has decided to curtail its R&D work in hardware accelerator technology.

Still, Hajjar counters, "there are a lot of opportunities in application-specific hardware but we just don't have the resources to go chasing after all of them." In addition to accelerators and physical modelers, Mentor's Langelier sees possible opportunities in the computer-aided test area.

CAE vendors are always on the lookout for new opportunities in ASHW because of the plump margins of such products. ASHW helps keep Cadnetix's gross margins high up in the 80% range, says Niehaus. Adds Daisy's Moore, "It's a very profitable business."

ALDEN M. HAYASHI

Learning to win in a tough global economy

Some American electronics firms are coming back strong in world markets.

Cahners magazines will report on their progress

Like the first crocuses of spring, signs of a change in season have begun to brighten the electronics landscape. In reversal of a decade-long erosion of U.S. strength in electronic components and systems, American-built products are making new headway against foreign competition.

It is happening slowly but steadily, aided by the dear yen, but not entirely dependent on the yen staying expensive. And it is happening in markets that only a few years ago were considered all but lost to foreign imports. Hewlett-Packard Co.'s gas chromatographs, Motorola Inc.'s pagers, Xerox Corp.'s smaller copiers: these are but a few examples. IBM, which fertilized the growth of Pacific Rim electronics industries by externally sourcing close to 95% of the contents of its original Personal Computer, has returned to tending its own gardens. Roughly 60% of the components and assemblies in the new Personal System/2 models have an internal source.

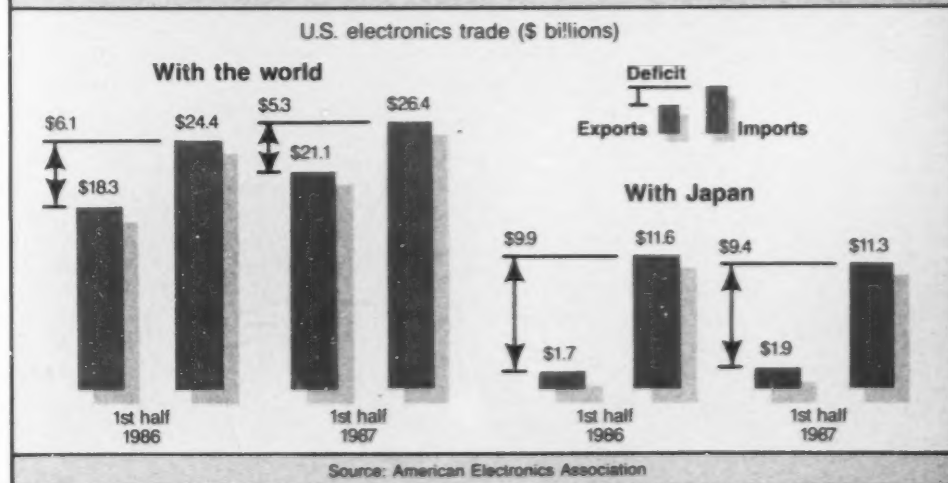
It is not yet clear that the improved competitiveness of America's leadership

firms can be matched on a broad basis. Last year's electronics trade deficit with Japan reached an all-time high of \$20.4 billion. In office and computing machinery, long an export strength for the United States, the U.S. trade balance has shriveled to less than \$1 billion. But there are some signs of broad-based improvement. The American Electronics Association reports that the U.S. worldwide electronics trade deficit shrank from \$3.1 billion to \$2.6 billion in the first quarter of 1987. Also contracting slightly was the U.S. electronics trade deficit with Japan, down from \$5.2 billion to \$4.6 billion.

If the base of recovery is to broaden significantly, more U.S. manufacturers will have to take their cues from the top tier of leadership firms. These are the U.S. firms successfully reducing costs, shortening product development cycles, trimming waste, raising yields and steadily, often dramatically, improving the quality and reliability of their products.

Interestingly, all of these firms seem to have come to a clear and early understanding of the same simple competitive reality.

The U.S. electronics trade picture begins to brighten. . .





KEEPING AMERICA COMPETITIVE

Innovative design — important as it is — is no longer enough to insure long-term market success. Technology goes only so far in a world where governments subsidize native industries and where intellectual property rights are often scorned. Mastery of the broad spectrum of quality disciplines underlies the revitalization of companies like Hewlett-Packard, IBM and Xerox. In other cases, competitive strength derives from superiority in a single function: the rationalization of scheduling, the mastery of advanced packaging techniques or flawless execution in marketing.

Perhaps most significant is the new emphasis on interdisciplinary teamwork. Cross-pollination between professionals in departments traditionally insulated from each other is helping companies design products that can be more economically sourced, more efficiently produced and more simply tested. Interdisciplinary teamwork between, for example, design and manufacturing engineers, between product planners and key suppliers, insure that problems are solved early — and at minimal cost.

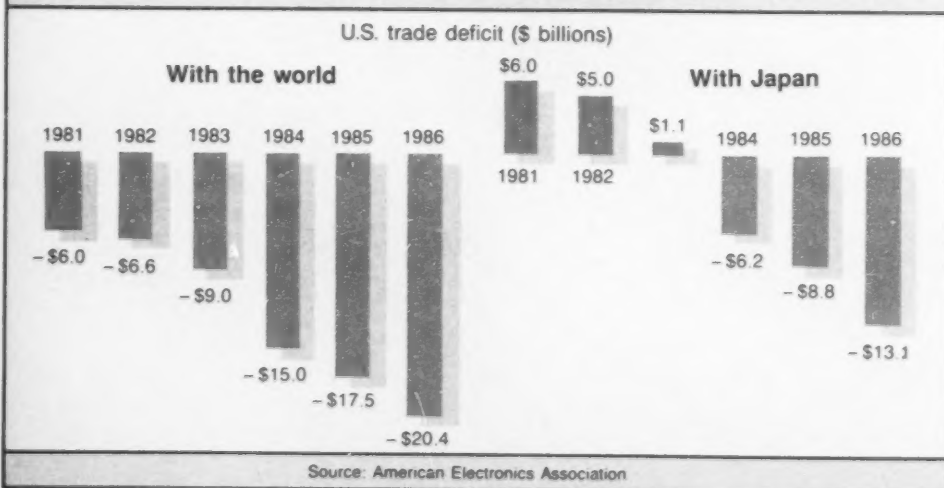
Teamwork is also the theme of Cahners Publishing's Keeping America Competitive series. Because the barriers between departments have blurred; because Cahners electronics publications reach readers in all major corporate functions; and because competitiveness is the single most important issue facing U.S. electronics and systems companies; nine Cahners publications have agreed to jointly address this theme. These nine magazines — Electronic Business, along with Datamation, EDN, EDN News, Electronics Purchasing, Electronic Packaging & Production, Mini Micro Systems, Semiconductor International and Test & Measurement World — have combined circulation of more than 800,000 and last year published more than 11,000 editorial pages. Each magazine will make regular contributions to the series.

In this first feature, the spotlight falls on Xerox Corp., the target of a decade-long furious Japanese assault on the office products business. Xerox, bloodied but not bowed, has emerged a far stronger and more disciplined company under the forceful leadership of David T. Kearns. □

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...after years of deterioration



MICROPROCESSORS

Move over, Intel-Motorola. Here come the "Others!"

Among the American players in the microprocessor game, application-oriented vendors are making substantial headway

By Valerie Rice

Microprocessors are changing jobs. Once firmly ensconced as the host central-processing unit in a PC or workstation, microprocessors are being forced to find other, more diverse jobs in remote, and perhaps even unheard of, locations.

Not only are they moving around, they are multiplying at phenomenal rates.

And they're changing from the generic, vanilla-flavored product that did almost anything, to a new application-specific microprocessor that is tweaked and focused to do a particular job. For the first time, "a microprocessor does not have to solve all the problems," Integrated Circuit Engineering Corp. market research manager William J. McLean says.

The reason, of course, is competition. For many customers, there are only two microprocessor companies: Intel Corp. and Motorola Inc. "Motorola and Intel are clearly the winners," stresses Altos Computer Systems Inc.'s vice president Jeff Bork. "Demand is clearly behind the winners."

But for U.S. semiconductor manufacturers wanting to play in the microprocessor world — and there are a number of them, many with 32-bit offerings — opportunities would appear to be limited.

Among U.S. players in the market (excluding six of the top 10 microprocessor manufacturers, all of which are Japanese), Intel will have 44% of the 1987 dollar market share for 32-bit microprocessors; Motorola will have 40%; and the "Others" — including Advanced Micro Devices Inc., Harris Corp. and National Semi-

conductor Corp. with its newly proposed acquisition, Fairchild Semiconductor Corp. — will have the rest. That's out of a market that's only about \$375 million, according to ICE. Also, the Scottsdale, Arizona research firm forecasts that the share of market in the 32-bit arena will change in 1991 to Intel and Motorola with 35% and 33%, respectively, while the "Others" will increase to 32%. The total market in 1991 is predicted to be \$1.3 billion.

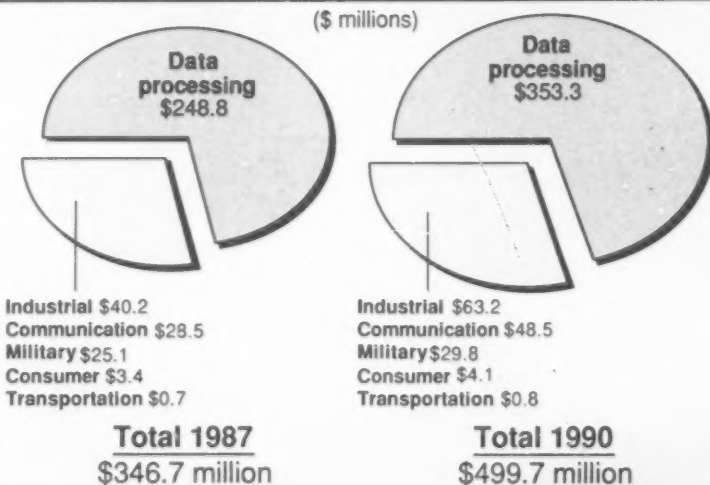
Additionally, 50% of 32-bit microprocessors are going into the office automation market this year, according to ICE, with 40% going into workstations, and the remaining 10% making up the "other" category. The two

largest applications, PCs and workstations, are the areas where Intel and Motorola are leaders.

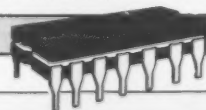
Obviously, general-purpose microprocessors will continue to dominate the market, at least in the areas of personal computers and workstations. Companies directly challenging the dominance of Intel, Motorola and National will be hard pressed to make an impact on the market, McLean says. "Who else besides these three are going to be major players?" McLean asks. AMD, which claims to be challenging Intel and Motorola in "their next generation" will be unable to take their place, McLean predicts.

And some customers agree. Altos' Bork says that his company is a com-

U.S. consumption of microprocessors



Source: Dataquest Inc.



mitted "Intel house" despite the fact that the company offers Motorola's 68020 in its OEM channel. The high level of acceptance and recognition that Intel products have in the market will keep Altos a long-term customer, Bork says. "The most important thing is compatibility," Bork says. "We have a huge base of software (XENIX System V) that we have to remain compatible with. I don't see a place for three microprocessors. You can put a chip on that may be more powerful, but for our multiuser systems, throughput is more important than pure power."

That is not to say, however, that there aren't market opportunities for other, more focused microprocessors today in the United States. But the opportunities are less obvious than PCs or workstation and often require some redefining on the part of both the engineer and the marketer. And, as McLean cautions, even in 1991, the market for non-PC or workstation applications is only going to be 25% of the total. But for companies looking for a steady revenue stream, and not for a "save the company" strategy, plenty of money can be made in microprocessor niche markets.

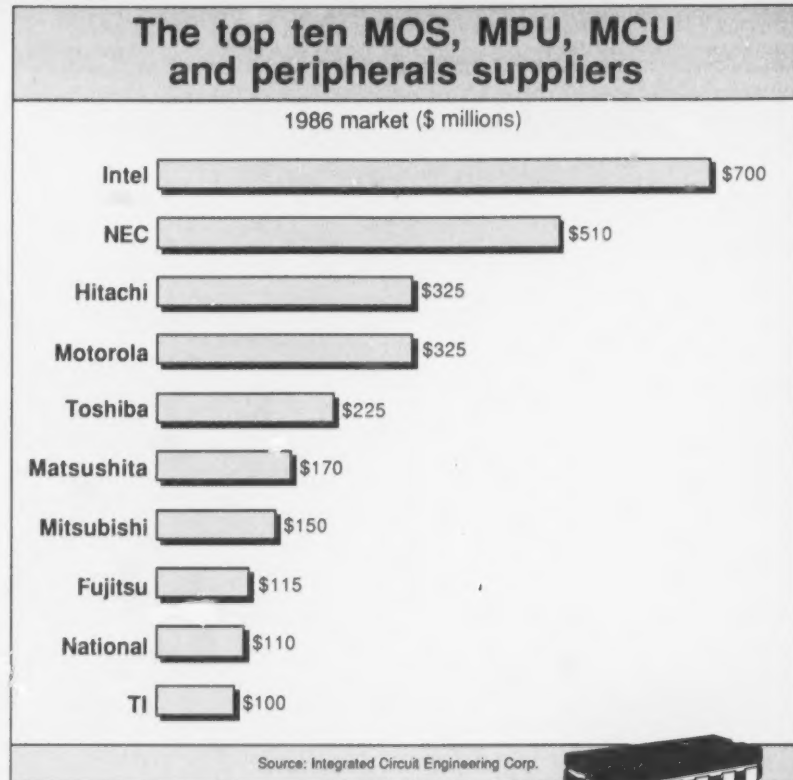
Host or no-host

Distributed processing, where computing moves from a central location or chip (like the host CPU of old) to a more decentralized, job-sharing environment, is made for application-specific microprocessors.

According to Dataquest Inc.'s industry analyst Alice Leeper, the number of microprocessors in a personal computer has grown dramatically in the last five years. In 1982, a PC had two microprocessors, one for the central processing unit and one for the keyboard. In 1987, an average PC has between five and six microprocessors, one each — typically — for the machine's CPU, keyboard, display and/or graphics, the I/O disk, and the math coprocessor. Some 32-bit systems even have cache memory controllers, Leeper says.

This growth in the number of microprocessors, coupled with user demands for more complex central processors, as well as more speed and less space, has created a market where peripheral chips can step in to offload some of the duties once assigned to a host CPU.

Texas Instruments Inc. is banking on this trend, says marketing manager Jim Huffhines. "We have seen



this trend, over a long time, of products going from general-purpose to user-specific, and in between these two extremes there is application specific. We are focused on the application-specific class of microprocessor."

TI's strategy is to compete by coexisting. Huffhines says that the company concedes the installed base of Intel and Motorola products and soft-

Embedded controllers are sort of the unsung heroes of the micro-processor arena

ware, and is willing to take the peripheral functions left undone by those host processors. TI is aggressively pursuing microprocessor slots for digital signal processing (DSP) with its TMS 320 family; local area network applications processing; graphics with the 34010; and speech synthesis and recognition.

The dilemma facing TI's customers, Huffhines says, is how to continue to increase performance and remain competitive, while preserving the software base. "You can only shrink geometries so much," Huffhines says. "We see everyday customers adding to their box to improve performance because their customer

wants them to improve performance." With dedicated microprocessor chips that concentrate solely on one area of a system's performance, overall performance can improve dramatically, Huffhines says. Volume is the other advantage to TI's strategy, he continues. "We'll have more processors in a PC than Intel has."

At Fairchild Semiconductor, which National agreed to purchase last month for \$122 million in securities, coexistence is also the name of the game. Like TI, Fairchild "will very generously keep the things that drive the keyboard and the displays," says Stav Prodromou, executive vice president and general manager of the custom and microprocessor unit. "Those are very high volume things, and we want to keep them," he says.

Ironically, however, Fairchild's major customer, Intergraph Corp., uses an Intel 80386 as an I/O processor, while the Clipper is used as the system engine.

Low-profile markets

Embedded controllers are sort of the unsung heroes of the microprocessor arena. The embedded controller market encompasses a number of fast growing areas including laser printers, robotics, avionics, disk subsystems and process control — all attractive segments to market players, old

MARKETS

and new.

One company that has staked out its claim in the embedded control market is National. It is certainly not the only player in the market, however, and others, such as AMD, Intel, Motorola and TI are all after a piece of the action.

Intel's 386 marketing manager Claude Leglise says that although the trend toward 32-bit embedded controllers has gone fairly slowly at Intel due to the preponderance of 8- and 16-bit solutions, he feels that by 1990 the trend will pick up dramatically. "Eighty percent of our business is driven by software," Leglise says. "The reusability of software is really the issue. You put it in the box and close the lid. With the embedded stuff, software is not part of the equation. That leaves lots of room for lots of different options."

National, with its 32532, is well-positioned to "have a shot at it," Dataquest's Leeper says. According to 32000 product marketing manager Anne Wagner, the company's primary target is laser printers, where "we expect to dominate," she says.

The reason that National has embarked on its peripherals strategy, Wagner says, is because of the great demand in the PC market, which has fueled the need for faster and higher performance peripherals. There is also high volume in peripherals.

Probably National's biggest ace in the printer market is its recent deal with Canon Inc.'s office automation division, which is responsible for an entire line of office products from facsimile machines to systems and of course, laser printers. The deal with Canon, described as a joint technology development agreement, has National supplying the 532, and other parts from its 32000 line, to Canon, which will in turn incorporate those chips into future products. Motorola, which has sold its 68000 line to Canon in the past, will continue to do so, says Jeff Nutt, a Motorola marketing manager. And he does not see a downturn in sales as a result of the National agreement.

This relationship with Canon, which market research firm InfoCorp estimates has 97% of the laser printer market, should help establish National firmly in this market, analysts believe. Dataquest's Leeper says that any time a company has a relationship with the No. 1 or 2 supplier in a market, it is bound to be a relatively high volume success.

However, competition in the em-

bedded controller market is heating up. Intel now has an Embedded Controller Group. TI is in the market with its DSP products, and AMD has said publicly that it plans to position its new 29000 in several of these markets, including laser printers. Motorola's customer list for the 68020 line includes over a dozen companies with embedded controller products, and Motorola says that percentage of its market is increasing. Just in telephone switching alone, Motorola's Nutt says, customer Northern Telecom can use 1,400 of the 68020 per system, and in some cases, it could use as many as 5,000.

AMD, probably the most difficult to judge because they are not shipping product, may also have the toughest time of it, analysts say. AMD, which

The military market will consume \$25.1 million worth of microprocessors by 1987

wants one-third of its business in host processors and the rest in embedded-type applications, will likely do well at the "Corvette" level of host product — very high end and high average selling price, and relatively low volume, one analyst says. However, they are probably well-positioned in parts of the embedded market where software freedom can make the choices much easier.

Other markets

In addition to embedded control and peripheral chips, microprocessors are increasingly going into other markets.

At Fairchild, for example, officials claim that the Clipper has had a high degree of acceptance in the military, and the company plans to release a military version of the chip in the near future. According to company executives, sales of the Clipper to the military in the future could account for as much as one-third of revenue, but only taking up 10% of the volume. Dataquest estimates that the military market will consume \$25.1 million worth of microprocessors in 1987, up from \$17.2 million in 1986. That figure will grow to \$29.8 million in 1990.

Telecommunications is also growing, and is a major area for a number of players including Fairchild's new parent, National, and Motorola. Tele-

communications, which is forecast to consume \$28.5 million microprocessors in 1987, will jump dramatically to \$48.5 million by 1990, Dataquest says. Those numbers dovetail with TI's view of the market, which reflects some slowness in acceptance of local area networks, Huffhines says. However, IBM's Token Ring LAN, in which TI has participated, is gaining market share, Huffhines says, and so the outlook for telecommunications looks bright.

For Motorola and others, the consumer segment of the market is holding up well — with toys, optical disks, cameras and other equipment showing increasing numbers of chips per part. Dataquest is only forecasting moderate growth in this area, however, from \$3.4 million in microprocessors consumed in 1987, to \$4.1 million, by 1990.

Inmos Corp., Colorado Springs, which makes the Transputer, has had to wait several years since the product's introduction in 1985 to see some non-board-level applications. Recently, however, the company has two brand new applications to boast of: a picture phone, developed by a Japanese company, that transmits a still picture across a phone line every eight seconds; and a computer for analyzing fingerprints.

Dataquest's Mel Thomsen, in talking about the Transputer, says that these new applications take advantage of what the processor does best: imaging processing. "There isn't enough business out there to support all those microprocessors," he says, so companies need to do what Inmos has done and "break down the problems into little pieces to be solved" by individual processors. This strategy allows the development of products never done before.

And, occasionally, fairy tales do happen. Take, for example, Fairchild, which now sells its Clipper to Intergraph for use in that company's new workstations. In a portion of the business, Fairchild supplanted its new owner, National, which still sells the 32032 to Intergraph for its older line, but is not represented in its new machines. Intergraph's sales support workstation marketing manager Gene Grindstaff says that Intergraph had reached a point where it was looking around for the next step in functionality and performance in workstations, and the Clipper's 5 MIPS performance was impressive to the company. "The Clipper has a lot of growth potential," Grindstaff says. □

CONTRACT ASSEMBLY

Only those with deep pockets need apply

Launching an SMT contract manufacturing business can be profitable, but it's not always as easy as it seems

By Carol Suby

Contract manufacturers offering surface mount technology (SMT) report that business is proceeding at a rapid clip, thanks in large part to a return to normalcy in the computer industry.

The value of surface-mount contract work being performed in the United States should reach \$260 million by the end of this year, and is forecast to hit \$1.24 billion by the end of 1992, reflecting an average annual growth rate of 62.8%, according to research firm Dataquest Inc. in San Jose.

The data-processing segment of the industry is currently fueling this fire and accounts for 44% of surface mount work being performed by assembly contractors, according to Dataquest. For example, over the past 18 months Interplex Technologies Corp. (ITC), the surface mount division of Interplex Industries Corp., received approximately 7,000 inquiries, although only 300 turned into orders. According to Walter Bailey, vice president of this Hackensack, New Jersey-based company, most of Interplex's surface mount business is coming mainly from major computer companies — and the same is true, he says, of other contract assemblers.

Far behind data processing in the No. 2 spot is communications, which accounts for 17%, followed by military at 14%, industrial at 10% and consumer at 8%.

And because the technology — which involves placing components directly onto a printed circuit board rather than by inserting leaded devices — allows manufacturers to fit more devices into the same space, demand by customers is accelerating.

At Universal's Specialized Electronics Products division (SEP), in Binghamton, N.Y., for example, sur-

face mount revenue is spiraling from 10% of last year's sales, to 30% this year, and could climb as high as 40% during 1988, according to Ronald Budacz, vice president of this division. He estimates his contract manufacturing operation is currently placing approximately 1 million surface mount components per day.

SEP's overall success in the contract manufacturing business has been strong enough, in fact, to warrant spinning off this contract manufacturing arm of Universal into a separate company. As of Dec. 31, 1987, SEP will be formed into Dover Electronics Manufacturing Inc., and become a member company of Dover

Technologies International Group, a subsidiary of Dover Corp.

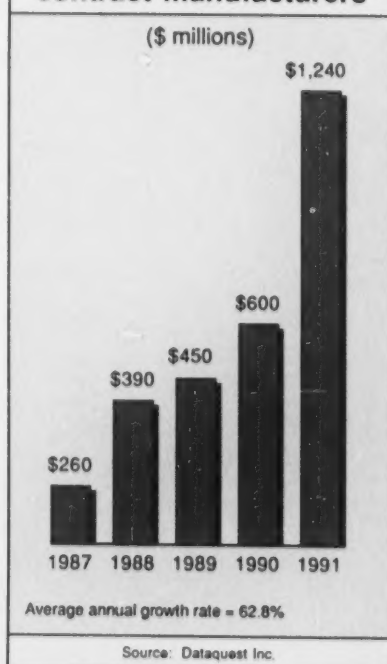
Not for everyone

Despite the attractive growth figures, subcontracting surface mount jobs is not for everyone. Not only is it very capital intensive, it also takes quite a long time to get over the learning curve, says Roger Main, president of IEC Electronics Corp., a privately held contract manufacturer whose 1986 revenue was approximately \$16 million. As early as the 1970s, this Newark, New York-based company was producing boards with surface mount components. But, about 18 months ago, IEC had to scrap all of its surface mount equipment and spend \$3.5 million to replace it, says Main, who has just ordered even more equipment, to the tune of approximately \$750,000.

Indeed, putting together a high-speed surface mount production line — an average of 3 million components placed per month — can cost as much as \$800,000 to \$1 million, and yet the equipment obsolesces very quickly. So says Winston Chen, president of San Jose-based Solelectron Corp. Also, the manufacturing process of SMT — which involves high densities, tight tolerances and a difficult soldering process — is five to 10 times harder to execute than through-hole technology. "In addition, 'there is a shortage of talent and expertise' to make the production process a reality, says Chen.

Even when a company is willing to make the commitment, serious problems can occur. In 1985, NCR Corp. began operating a surface-mount assembly line for its Tower family of supermicro computers at its engineering and manufacturing facility in Columbia, S.C. After investing a "sizable amount" in surface-mount production equipment, and then be-

SMT revenue of contract manufacturers



ing left with excess capacity, the company initially decided to "really go after" the contract business, says John Schafer, manufacturing coordinator. However, "as we got into it, we ran into some test problems," Schafer says. For now, NCR hasn't contracted with any outside clients, but hopes to do so once the test problems are resolved.

For these reasons, the major players in the sport of surface-mount contract assembly are deep-pocketed, multimillion dollar firms whose full line of services — referred to as "turnkey" — extend from helping a customer with board designs and product prototypes, to performing component procurement, assembly, test and packaging.

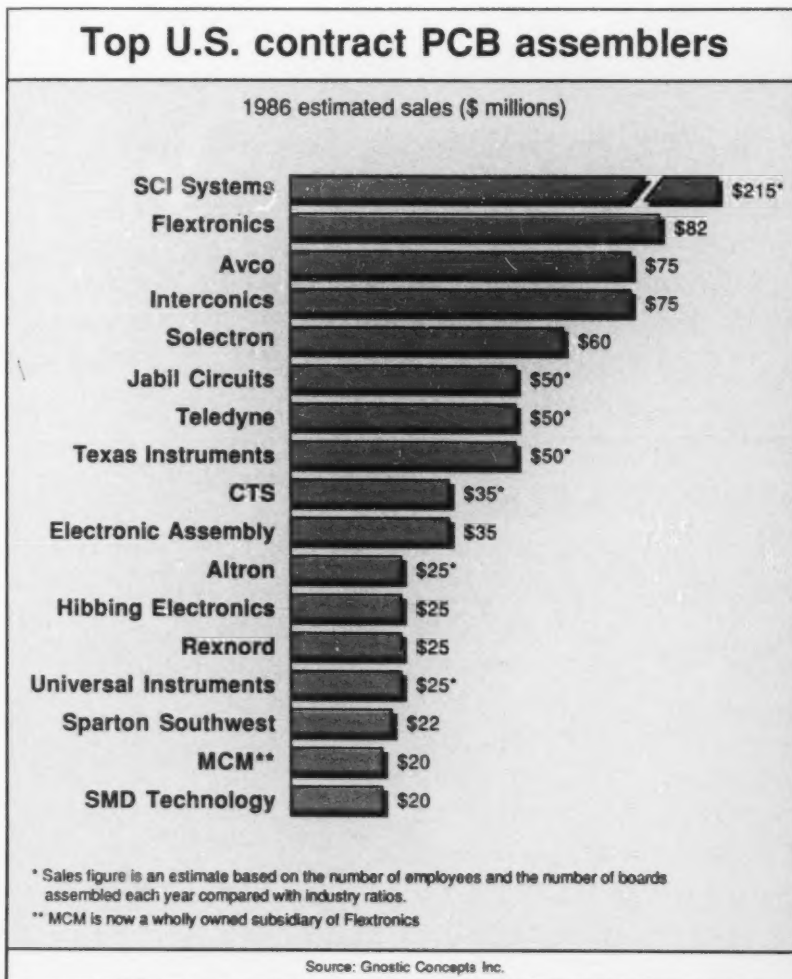
Avco Electronics/Textron, with an estimated \$75 million in revenue last year, has more than six design engineers working on surface mount projects, and is currently adding to that staff, according to James Welchly, director for marketing at the Huntsville, Alabama-based company.

Flextronics Inc., the second largest U.S. contract manufacturer with 1986 revenue estimated at \$82 million, has more than 20 members of an engineering group involved in all facets of SMT, according to company president Robert Todd. In addition to an extensive engineering staff, the Newark, California-based company has more than \$3 million invested in surface-mount capital equipment and offers turnkey services from design and procurement to building a complete product in a box. Even though many of the larger contract manufacturers have developed their staffs in house, Flextronics has added a number of capabilities and extended certain services via acquisitions. This year alone, Flextronics has purchased three companies: JTE Graphics, a designer of PCB layouts for surface mount devices; and MCM Industries and Vortech Corp., two independent test houses.

Enter the OEMs

Another group of companies with substantial financial resources, large production facilities, worldwide purchasing power and a great deal of surface mount expertise is also jumping into the foray of surface-mount contract manufacturing. These are the original equipment manufacturers (OEMs).

When Kodak Apparatus Division (KAD) — the manufacturing arm of optoelectronics firm Eastman Kodak



Co. — was formed during the last quarter of 1984, a decision was made to take in subcontract work from outside customers. Of the more than 50 external clients KAD is currently servicing, 10 of those are for electronic assemblies and eight of those involve SMT.

Texas Instruments is taking in surface mount work at three locations. Its Data Systems Group in Austin, Texas, manufactures boards with surface mount components for other TI divisions, as well as for outside clients. The Industrial Systems Division, in Johnson City, Tenn., has more than five outside clients for surface-mount assembly work, and that number is growing rapidly, according to Charles Starks, contract manufacturing manager.

Starks reports that the division is currently exceeding capacity and is buying more production equipment to enable the facility to meet its sur-

face mount demand. TI's Semiconductor Group in Houston helps customers design memory boards that contain surface mount components. However, this represents far less than 5% of the Group's total customer-related business, says Robert Harrison, general manager of the Houston facility.

Xerox Corp. first offered third-party or subcontract services at its Wellingard City facility in Britain. Today, the company is trying to repeat its European success at its El Segundo, Calif., facility. So far, one "large customer" has been signed on and two more are in the process of signing up, according to Brian Weyman, vice president for manufacturing in Southern California.

Despite such an interest on the part of OEMs, money does not seem to be the primary motivating factor. Pretax profit margins in this business can run between 5% and 15%, accord-

MARKETS

Contract manufacturing abroad

ing to Pamela Gordon, president of research firm Technology Forecasters in Berkeley, Calif. And, few OEMs put profit at the top of their lists when justifying their reasons for being in the subcontract business. In listing KAD's rationale for taking on external clients, Kevin Moriarty, customer account manager at Kodak's KAD, maintains that foremost, Kodak wanted to fully utilize its plant. In addition, the company felt that by keeping in touch with outside clients, Kodak would stay technologically astute and would benefit by operating in a competitive environment.

But "there are limits to the extent of market share they [OEMs] will gain," cautions Charles-Henri Mangin, president of consulting firm Ceeris International Inc. in Old Lyme, Conn. Although a number of large equipment manufacturers have experience in surface mount technologies, Mangin says, "the big guys have difficulty competing with subcontractors." One factor is wages, which average between \$25 to \$50 per hour at OEM locations, but are closer to \$12 to \$20 at subcontractor locations. In addition, traditional contract manufacturers offer customers more flexibility and customers can better bargain with companies dedicated to servicing outside clients, Mangin suggests. Nevertheless, those who want a risk-free approach for assembly and want the insurance of a big name are attracted to the big manufacturers.

Because domestic contract manufacturers are servicing many customers that have a worldwide presence, opening facilities in Europe and the Far East seems like a natural business progression. Flextronics Inc. and the No. 1 U.S. contract manufacturer, SCI Systems Inc., are among the only major domestic players to currently offer offshore manufacturing, but others, including Universal/Dover's Specialized Electronics Products, are looking into such expansions. How important offshore capabilities will be in the future of surface mount manufacturing remains to be seen. But, for now, the trend in SMT manufacturing is to bring business back onto U.S. soil. [ELECTRONIC BUSINESS, April 1, 1987, p24]

Indeed, contract manufacturing

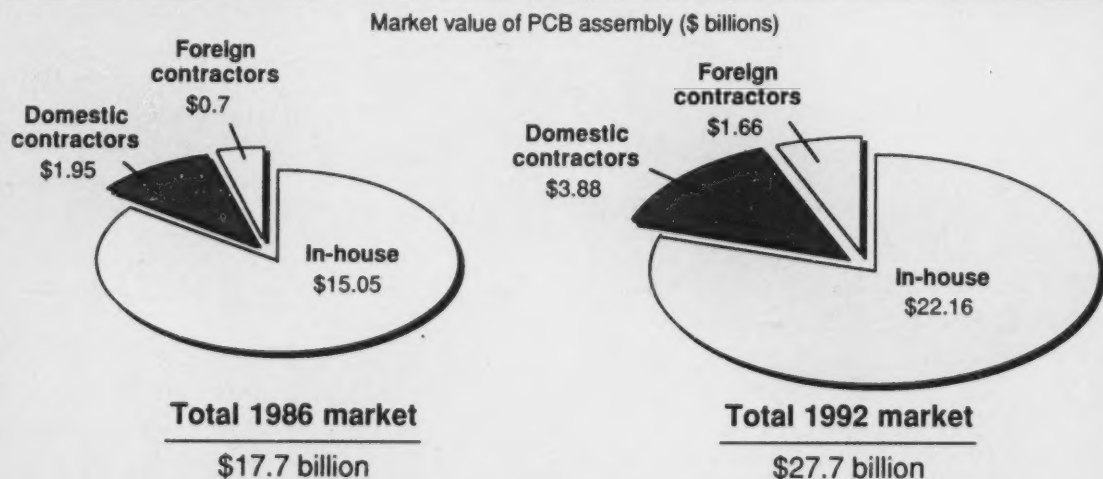
of SMT "will be a lucrative market in the good ol' U.S.A. for those contract manufacturers who want to stay here," says Ronald Budacz of Universal/Dover's SEP. Although Budacz believes that companies will not have to leave the United States as a prerequisite for survival, he is currently investigating the possibility of opening a manufacturing facility in the Far East.

Across the Atlantic, contract assembly work is also catching on in Scotland where a number of OEMs — such as Highland Electronics Ltd. and Timex Corp. — are winning contracts from the myriad electronics companies that have facilities in Britain. In addition, there are a number of dedicated contract assemblers — such as Keltek Electronics Ltd. — that are beginning to tread in SMT waters. □

Although the days of the mom-and-pop garage operations are numbered due to the complexities of SMT, opportunities remain for small to midsized firms. Started up in mid-1985, Interconnect Technology Inc., for example, specializes in the manufacture of boards that contain 100% surface mount components. The Beaverton, Oregon-based company — which claims it has capacity to

place 1 million components per month — also holds a patent for a laser beam process for routing circuitry through various layers of a printed circuit board. This patent, insists Allen Peecher, vice president for manufacturing, has helped Interconnect attract more than 30 customers, including Digital Equipment Corp., Hewlett-Packard Co., Intel Corp. and Tektronix Inc. □

Domestic contractors gain share in PCB assembly solutions



Source: Gnostic Concepts Inc.

JAPAN

The new bottom line in Japanese electronics

Some Japanese firms are doing surprisingly well, even though the high yen has played havoc with their margins

By Paula Doe

It was a terrible year for Japan's electronics sector overall. Earnings plummeted an average of 39% at the top 20 companies for fiscal 1986, which ended in March 1987 for most companies. But given the 19% appreciation of the yen against the dollar during the year, on top of a 27% rise the year before, it's a wonder the sector did as well as it did in the drastically altered competitive environment. Some companies even did surprisingly well.

ELECTRONIC BUSINESS compiles the latest available consolidated financial information from the major Japanese electronics companies from published Japanese materials and from the companies themselves, long before most of the companies publish their English language annual reports. We figure electronics revenue for these companies by the same standards we use for our annual listing of the ELECTRONIC BUSINESS 200. James Capel Securities Inc. helped us gather some of the latest figures this year.

Margins for the sector as a whole were miserable by every measure. Operating margins were squeezed to a mere 5 cents for each dollar of sales, on average, down even from last year's meager 7 cents. That was an average drop of 38%. Some individual companies fared far worse. Sanyo Electric Company Ltd. saw an 89% drop in operating income and Sony Corp., 75%. Alps Electric Company Ltd. and Sanyo had operating margins of a mere 1%.

The 39% average drop in net income meant average net margins slipped to 2% of sales, down even from last year's slim 3%. The roster of big names earning only 1% on their multibillion-dollar consolidated worldwide sales includes Alps, Canon

The high yen devastates Japanese margins

Composite 1986 performance:
Japanese versus U.S. electronics companies

	Japanese top 20	U.S. top 20	U.S. top 200
Electronics revenue (\$ billions)	\$137.3	\$174.4	\$279.2
Change from 1985	+2.6%	+4.7%	+4.3%
Total revenue (\$ billions)	\$221.1	\$252.0	\$641.7
Change from 1985	-1.9%	-20.5%	-19.6%
Net income (\$ billions)	\$4.3	\$13.2	\$26.7
Change from 1985	-38.8%	-25.8%	-24.6%
Net income/sales	2%	5%	4%
Return on equity	4.3%	10.8%	10.2%
Revenue per employee	\$164,400	\$89,000	\$102,300
Change from 1985	-23%	+2%	-8%
Net income per employee	\$3,100	\$4,000	\$4,300
Change from 1985	-47%	-11%	-14%
Exports or foreign sales/total sales¹			
1986	40%	46%	25%
1985	46%	27%	14%

Japanese percentage change figures are based on yen values.

¹ Japanese figures are parent company exports only, and thus include the parent's sales to its overseas subsidiaries for resale abroad, but not overseas production by the subsidiary. The U.S. figures, however, include both exports and overseas production.

1985 figures are as originally reported last year using ¥180 = \$1.

Source: ELECTRONIC BUSINESS

Inc., Citizen Watch Company Ltd., Fujitsu Ltd., Mitsubishi Electric Corp., NEC Corp., Omron Tateisi Electronics Co. and Toshiba Corp.

The top Japanese companies earned only 4% on their shareholders' equity, compared with 11% for the top 20 U.S. companies. Return on total investment will be significantly lower still, probably around 2%, given the high levels of debt usually carried by the Japanese companies, but reliable figures were not yet available.

Still, it's a wonder these results aren't worse, given the dismal conditions these Japanese companies had

to cope with. Japanese earnings were down 39%, and earnings of the top U.S. companies were down 26% themselves, despite the advantage of the cheap dollar. And although Japanese margins were slimmer than usual, none of the major companies lost money.

Even the few companies that finished last year in the red, like Oki and Pioneer Electronic Corp., managed to slash costs, move away from exports and move up to higher value-added products to make a little money this year. And despite the adverse environment, companies selling

FINANCE

such unglamorous and supposedly low-margin products as components and consumer electronics managed to net 4% to 6% of sales, matching the 5% average of the top 20 U.S. electronics companies. Matsushita Electric Industrial Company Ltd. maintained operating margins of 7% and netted 4%, TDK Electronics Company Ltd. netted 4% on an operating margin of 10%, and Kyocera netted 6% on operating margins of 12%.

Reshaping the industry

As the high yen forces individual companies to restructure, it is also reshaping the industry as a whole. Many of the old generalizations that used to be drawn about the Japanese electronics industry aren't so true anymore.

For one thing, the new world order of 140 yen to ¥150 to the dollar is devastating that legendary Japanese

productivity. Falling prices, slumping sales, excess capacity, excess domestic employees as production is shifted overseas, cutbacks in capital investment, the shift to making new and more complex higher value-added products — whatever the reasons, the

The new world order of ¥140 to ¥150 to the dollar is devastating that legendary Japanese productivity

top Japanese companies' revenue per employee slid 23% for the year, on top of roughly a 33% drop the year before. That brings the Japanese figure down to 1.85 times that for the top 20 U.S. companies, and only 1.6 times that for the ELECTRONIC BUSI-

NESS 200, instead of 2 times to 3 times the U.S. level as it has been in some past years.

The top U.S. companies surpassed their Japanese rivals in earnings per employee this year, as the Japanese net income per worker fell 47%, to \$3,100. That was only 78% of the U.S. level. The top 20 U.S. electronics companies netted \$4,000 per employee, and the top 200, \$4,300. Last year net income per employee in the two countries was about equal. The year before, the Japanese had a significant advantage.

In this new state of the world, the Japanese are obviously no longer prospering on massive exports of efficiently mass-produced commodity products. Exports fell from an average of 46% of total parent company sales last year to 40% this year. These parent company only figures include sales from the parent company to its

Top Japanese electronics companies

Rank	Company	Electronics sales (\$ millions)		Total sales (\$ millions)		Operating income (\$ millions)	
		1986	1985	1986	Percentage change in yen from 1985	1986	Percentage change in yen from 1985
1	Matsushita	\$21,900	\$17,889	\$31,335	-9%	\$2,135	-44%
2	NEC	16,779	12,361	16,779	5%	632	-37%
3	Hitachi	15,128	12,222	33,210	-3%	1,471	-30%
4	Fujitsu ¹	12,256	8,733	12,256	6%	393	-32%
5	NTT ¹	9,729	7,439	36,668	5%	4,945	-5%
6	Sony	9,076	7,333	9,076	-7%	53	-75%
7	Toshiba	8,105	8,889	22,655	-2%	353	-58%
8	Mitsubishi	6,300	4,167	14,435	6%	467	24%
9	Sharp ¹	6,200	4,150	7,868	-5%	—	—
10	Canon	5,800	3,450	6,091	-7%	206	-66%
11	Sanyo	5,700	4,767	8,226	-21%	53	-89%
12	Ricoh	3,400	2,838	4,507	0%	160	-28%
13	Oki ¹	2,791	2,272	2,791	4%	—	—
14	TDK	2,643	2,372	2,643	-10%	269	-48%
15	Alps ¹	2,400	1,900	2,532	3%	69	-55%
16	Pioneer	2,377	1,816	2,377	2%	—	—
17	Omron	1,908	1,540	1,908	0.5%	112	-32%
18	Minolta ^{1,2}	1,700	1,457	2,055	-3%	103	-33%
19	Citizen ¹	1,600	1,692	1,819	-3%	—	—
20	Kyocera	1,575	1,289	1,892	-1%	232	-2%

¹ Consolidation by Japanese accounting conventions, which differ slightly from U.S. Securities and Exchange Commission rules used by the rest of the companies.

² Preliminary estimate before release of final consolidated results. 1986 figures are converted at ¥146 = \$1. 1985 figures are as originally reported last year using ¥180 = \$1.

overseas subsidiaries for sale abroad, but do not include sales of goods produced by the overseas subsidiaries themselves.

New winners

And the new environment is producing some new winners and losers. Somewhat surprisingly, the companies doing best so far in the new world of the high yen are the specialized makers of passive components. Fattest margins this year belonged to Kyocera (12% operating, 6% net) and TDK (10% operating, 4% net). Omron also did better than most of the major computer makers, maintaining a 6% operating margin.

"The components makers were more flexible," notes Sharil Osgood, an analyst who tracks Japanese electronics companies for James Capel Securities Inc. in San Francisco. "Their products are easier to make

offshore, and they already had facilities. Alps increased its offshore production 80% last year, and it just upped its earnings projections for next year."

Also outperforming its larger and usually more profitable rivals this

Who saw significant sales growth? Fujitsu, 6%; Mitsubishi, 6%, Nippon Telegraph and Telephone, 5%; NEC, 5%; and Oki Electric 4%

year was Mitsubishi Electric. The company tied Fujitsu for most growth in revenue (6%), and it was the only one of the top 20 to increase its operating income. What's Mitsubishi selling so successfully? Defense electron-

ics, for one thing.

At 7% operating and 4% net, consumer giant Matsushita maintained better margins than the computer makers. The company did well on sales of domestic consumer products, raising its domestic sales from 63% to 70% of its total revenue, as it developed new products ranging from digital audio equipment to automatic bread makers and electronic pillows.

In marked contrast to Japan's traditional strategy of export-led growth, those companies that did the best this year were the ones that exported the least. Which companies saw significant sales growth? Fujitsu, 6%; Mitsubishi, 6%; Nippon Telegraph and Telephone (NTT), 5%; NEC, 5%; and Oki Electric Industry Co. Ltd., 4%. Which companies exported the least? Pretty much the same crew: NTT, 0%; Fujitsu, 18%; Omron, 18%; Mitsubishi, 24%; and Oki, 24%. □

Net income

(\$ millions)

1986	Percentage change in yen from 1985	Operating income as a percentage of sales	Net income as a percentage of sales	Sales per employee	Net income per employee	Return on equity	Exports	Fiscal year ended
\$1,121	-34%	7%	4%	\$230,600	\$8,200	8%	30%	11/86
103	-45%	4%	1%	166,100	1,000	5%	28%	3/87
676	-34%	4%	2%	206,300	4,200	6%	29%	3/87
148	-44%	3%	1%	137,300	1,700	3%	18%	3/87
1,014	-20%	13%	3%	123,500	3,400	—	—	3/87
287	-43%	1%	3%	186,500	5,900	7%	62%	10/86
234	-43%	2%	1%	161,800	1,700	4%	29%	3/87
73	-68%	3%	1%	197,700	1,000	3%	24%	3/87
142	-42%	—	2%	147,100	2,600	6%	53%	3/87
73	-71%	3%	1%	171,600	2,100	4%	74%	12/86
14	-94%	1%	0.2%	117,500	200	4%	49%	11/86
75	-29%	4%	2%	156,000	2,900	5%	31%	3/87
15	+329%	—	0.5%	214,700	1,200	-2%	24%	9/86
106	-49%	10%	4%	163,300	6,600	6%	41%	11/86
29	-55%	3%	1%	126,600	1,500	5%	29%	3/87
37	+319%	—	2%	191,100	3,000	2%	40%	3/87
21	+18%	6%	1%	142,800	1,600	1%	18%	3/87
38	-50%	5%	2%	—	—	5%	79%	3/87
23	-6%	—	1%	—	—	3%	61%	3/87
120	-5%	12%	6%	118,300	7,500	6%	44%	3/87

Source: ELECTRONIC BUSINESS

DATABASE

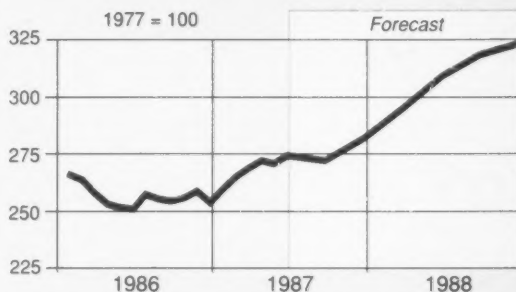
Computers and office machinery

The computer, peripherals and related equipment market continues its upswing. Production is running about 10% above the June 1986 level, its most recent low. Employment also edged up in June and, though still well below 1985's levels, is expected to increase steadily through 1988 as production increases. The decline in the dollar has influenced buyers abroad to buy more U.S. computer equipment. Exports in the first half of 1987 were \$8.6 billion, 19% higher than the year-ago period. Imports also picked up, thus widening the trade gap, but further signaling the recovery of the computer market and the willingness of businesses to increase investment in new machinery and replace older models.

Edited by LINDA STALLMANN

Computer industrial production

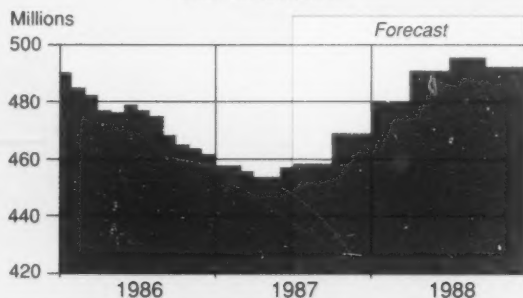
Seasonally adjusted index (SIC 357)



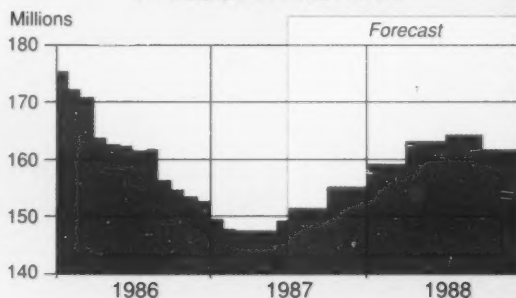
Source: Federal Reserve Board; Forecast: Cahners Economics

Computer industry employment

All workers



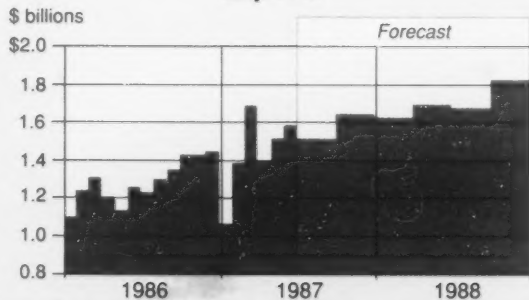
Production workers



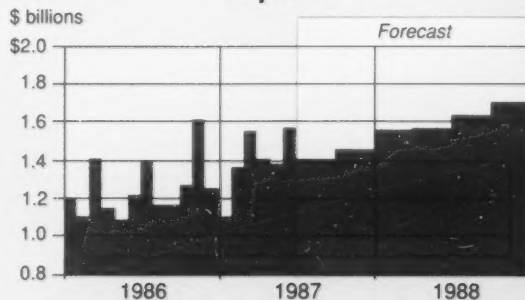
Source: U.S. Department of Labor; Forecast: Cahners Economics

Computer exports and imports

Exports



Imports



Source: U.S. Department of Commerce; Forecast: Cahners Economics